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pendages of trilobites, and in particular of *Asaphus platycephalus* Stokes, as published by him in 1871. The other bears the title, "Notes on the appendages of Trilobites. Note to accompany three woodcuts of *Asaphus megistos*, a trilobite discovered by Mr. James Pugh, near Oxford, Ohio, in the upper portion of the Hudson River group." The figures are a reproduction of Mr. Mickleborough's.

A. H. Worthen, in Bull. No. 2 of the Illinois State Museum Nat. Hist., publishes descriptions of two new species of Crustacea, fifty-one species of Mollusca and three species of Crinoids from the Carboniferous formation of Illinois and adjacent States. No illustrations whatever accompany these numerous descriptions.

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THE CLAM-WORM.

BY SAMUEL LOCKWOOD, PH.D.

WALKING at low tide on the wet flats of the New Jersey shore, the stranger is surprised by little spurts of water suddenly springing from the sand. These jets reveal the hiding places of the soft clam, or "nanny nose," a corruption of the Indian name "maninose." This discharge of water at the approach of footsteps, thus betraying its retreat, is an act which the mollusk cannot help. The home of the bivalve is often many inches deep in the sand, but the extensile siphon must reach the surface. Alarmed at the tremor of the sand caused by the approaching steps, this organ is so rapidly withdrawn, even down into the valves at the bottom of the perpendicular burrow, that the sudden collapse expels the water with which the siphon and other cavities of the body are filled. Without such result the rapid retreat of the siphon from harm's way would be impossible. After one of these squirts I have dug fully fourteen inches deep, and found the clam with all its parts snugly tucked within its two valves.

The water ejected as described is simply the fluid which was taken in before the tide went out. If the observer will be quiet and keep motionless for a few minutes the clam may soon regain its confidence, and the tip of the siphon, with its two pretty orifices—the inlet and the outlet, again appear at the little hole in the sand. Now let one's foot be moved, and again the siphon is instantly withdrawn; but there is no spurt as before, because the previous effort had emptied it of water.

The systematists call our mollusk *Mya arenaria*, but in popular speech, because of its siphon, it is sometimes known as the stem-clam, and to distinguish it from *Venus mercenaria*, the quahog, round-clam or hard-clam, it is often called the soft-clam and long-clam.

Busily delving with short-handled hoes, men and boys may be seen, at low tide, all over these sandy flats. They are " the clammers." Long practice, with perhaps inherited instinct, has made these persons expert in detecting the signs of the places of these mollusks, even when not betrayed in the usual way. They certainly have that fine eye for discernment which comes of being to the business "bred and born." Though perhaps preferring such places, these soft-clams are not limited to the sandy flats. They are also found in gravelly and even muddy beds.

In digging the clammer brings to the surface many a fine invertebrate of much interest to the naturalist. Among these quite often is a gayly tinted annelid, a quasi-aquatic myriopod. We watched one of these delvers, a youth quite bright in his own way, and respectful too, except perhaps to some student pedant whom he cannot understand, and whom he seems to regard as a "dude in larning," as we found out a little to our cost. There! He turns up an annelid now, and we exclaim—" What a pretty Nereid!" To which, with a quizzical cast of the eyes, he responds: " Nary time, Mister! That's only a clam-worrum!" Glad to become a learner upon opportunity, we ask why it is called a clam-worm. The answer, now politely given, is: " Because its gin'ally found along with the clam. Most like it's clam-feed, or something in that way."

The best known of these Nereids in our Eastern waters are *N. limbata*, *N. virens* and *N. pelagica*; of these three the chances are many that the Jersey clammers' acquaintance will be restricted to the first one mentioned, though all would be the same to him. And it must be known that though called a clam-worm, Nereis is no pariah, but the very highest in its class, the Annelides. And *N. limbata* is sometimes found seeking the higher society of the marine invertebrates. Verrill says of this species: " Both males and females were often found among the barnacles and ascidians on the piles of the wharves at Wood's Holl, but the males were the most abundant, while the reverse was the case with those dug out of the sand and gravel at the shores." The same author tells of their habitats in shelly and gravelly beds, and even of their floating in great numbers at the surface of the water. This statement recalls a thrilling experience of our own many years ago inside of Sandy Hook. All told we numbered three, in a sail-boat, and our one object, squidding for blue-fish, the gamey *Pomatomus saltatrix.* The wind was so stiff that we had enough on our hands to take care of ourselves and our little craft. It was a very warm day in August, and to my astonishment we went through a floating bank of these clam-worms, They lay close together, and the float seemed several hundred feet long, and owing to the high wind it was disposed in concentric drifts, or wind-rows. Our game was up, touch our squids Pomatomus would not—he had come to a banquet worthy of the gods—I cannot affirm whether the banquet had attracted them, but just after the Nereid course was finished, a school of Menhaden appeared. The blue-fish went for them, and the scene was simply pitiful. In their frantic efforts to escape, the poor things piled themselves one upon another, and the jaws of the terrible blue-fish, like a thousand shears, cut into them, while the air was alive with gulls screaming in delight over the carnage, as they were continually pouncing upon the floating fragments of the gory feast. As the Nereids deposit their eggs near shore, and as this scene was witnessed inside of Sandy Hook bay, a good place for their breeding, and as my memory serves, the worms were small, it has seemed to me that they were young individuals.

Wishing to resume study of the Actiniæ, I procured from Fall river some specimens of *Metridium marginatum*, with a quantity of the green sea-lettuce, *Ulva latissima*, among which was one tuft of the succulent red alga, *Rhabdonia tenera.* The plants soon took on a fine growth. I became annoyed, however, at the unsightly appearance of ragged holes in the green fronds, and their number steadily increasing. Soon the depredator was detected at work in a thick bunch of Ulva. The red alga was not touched. This annelid browsing was an interesting sight. For every one of its many segments was a pair of parapoda, or side paddles, with which, though the action seemed serpentine, it moved about a plant as easily as a bird around an evergreen when seeking insects on the tree. And what a pair of jaws, each with a row of small sharp teeth on the curve of the inner side, as if two tiny sickles could be converted into saws. The little beast was slashing remorselessly into these translucent delicate sheets of emerald gelatine. I said jaws. The whole apparatus has been called a proboscis—but such an exceptional one! The annelid in repose carries his jaws down his throat just over the œsophagus, and when he eats the two serrate sickle jaws are everted, that is, protruded, pharynx and all. This creature was our clam-worm, *Nereis limbata.* It moves in graceful ease through the marine meadows by means of its two long rows of parapoda, or natural oars. It has four eyes, and they see me too, for it disappears instantly. Its retreat is a little burrow in the sand, a transverse section of which would be nearly oval. The books say that the Nereis secretes a viscid fluid with which it lines its borrow. Its progress in this retreat is rapid, and it can move either way with equal ease. Its head is now at the entrance, hence it has turned in its burrow, and as this is pretty well filled by the worm's body, how does it double on itself? It has such a knowing look with its four optics, and four pairs of feelers, as if in its tentacular wisdom it were inspecting every object anent the cabin door. And then it has an amiable look, for that proboscis with its formidable jaws is concealed down the throat.

I found two others in the tank. Each was from two and a half to three inches long. Twice one of them was so accommodating as to make its burrow against the glass side of the tank. I now watched the movement in the burrow and saw how easily it could advance or recede; but I failed to see the doubling on itself. And then it was pretty to note that the paddle-like rami were never soiled.

How could I grudge my Nereids their inroads on the lettuce beds, as I deemed them vegetarians of the Simon-pure variety? I was feeding the Actiniæ with small pellets of raw beef. It occurred to me to tempt the Nereid from its simple fare with a stronger diet; so I dropped a bit of beef at the entrance to the burrow. The tentacular wisdom made a snap judgment—"fresh beef is good," for out popped the proboscis, that is, the pharynx and its formidable jaws, and the welcome morsel was hooked with a jerk into the burrow. How deceptive are appearances. Vegetarian indeed! My Nereids are rabid carnivores. Thence on I fed the Nereids beef whenever I fed the Actiniæ.

To the naturalist who uses the microscope, an old marine aquarium is fruitful of interesting minute forms of life, both plants and animals. This is certainly true of the micro-algæ. I observed one day what seemed to me a new form of algæ, little clusters of a deep orange color on the sandy floor of the aquarium. Each bunch was hardly more than an eighth of an inch in diameter. Some of the little cylinders of which a cluster was composed were put under the microscope. There was not the slightest appearance of any cell structure, nor even the presence of any distinct protoplasm. They were granular in composition, but there was no sac or case. They had something of the look, size excepted, of the casts in Bright's disease. These little tufts of tiny orange-colored cylinders kept on increasing. When two or three days old they turned white. I noticed that they were all in proximity to the burrows of the Nereids. They proved to be their excreta—enteric casts of their imperfectly digested food. That deep dull orange was still a puzzle, for when freshly cast these excreta were exactly the color of the calcareous crust which covers the horny axis of some of the sea-fans, Gorgonia. It was noticeable that since the beef diet had been begun, the Ulva was let entirely alone.

But there arose a famine in the land. No *fresh* beef could be got. Of course the Nereids could go back to the sea-lettuce, but they chose to let it alone. From "pickings" they turned to "leavings," or perhaps more correctly from "primes" to "middlings." Thanks to the gentle Cowper whose Task supplies the word befitting ears polite—every "stercoraceous heap" was soon eaten up! Our pretty Nereis, then, has a threefold appetency—since it is by turns a vegetarian, a carnivore, and even an autostercophaga! an eater of its own casts.

But such things are found in higher quarters. Dr. Rau, in his translation of the Jesuit Baegert, says of certain California tribes now extinct, that in its season they almost lived upon the fruit of the pitahaya, and when that gave out they were reduced to short rations. Says the missionary:

> "In describing the pitahayas I have already stated that they contain a great many small seeds resembling grains of powder. For some reason unknown to me these seeds are not consumed in the stomach, but pass off in an undigested state, and in order to save them the natives collect during the season of the pitahayas that

which is discharged from the human body, separate the seeds from it, and roast, grind and eat them, making merry over their loathsome meals, which the Spaniards therefore call the second harvest of the Californians." See Smithsonian Report, 1865, p. 365. Baegert's book was published at Mannheim, 1773.

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LIFE AND NATURE IN SOUTHERN LABRADOR.

BY A. S. PACKARD.

(Continued from p. 275 March number.)

AFTER roaming over the island and making pretty full collections of the insects, we paid attention to the marine zoölogy. Shore collecting is not as remunerative in Labrador as on the Maine and Massachusetts coasts. The most noticeable form is the six-rayed starfish (*Asteracanthion polaris*) which sometimes measured twenty inches from tip to tip of its opposing rays; its color was a dirty yellowish white, not red as in the common fire-finger, also abundant. The polar starfish is common in Greenland, and is a truly arctic form.

The common crab (*Cancer irrorata*) frequently occurred under stones, but the lobster was neither seen nor heard of; though common on the southern shores of Newfoundland it does not reach north into the Straits of Belle Isle. Among the worms which occurred at low water mark was the Pectinaria. On the New England coast it only occurs in deep water below tide mark.

Dredgings were first made at the mouth of Salmon river, a few rods from shore, in some eight fathoms of water in a firm deep mud. The most characteristic shells were gigantic *Aphrodite greenlandica*, large cockles (*Cardium islandicum*), as well as the pelican's foot (*Aporrhais occidentalis*), which occurred of good size and in profusion. In the soft mud occurred multitudes of the neat little sand star (*Ophioglypha nodosa*). Another form dredged on rocky bottom was *Cynthia pyriformis*, or the sea peach, and large specimens were cast up by the waves on the beach. Every spare day was given to dredging, and having been deeply interested in marine zoölogy by the writings of Gosse, in England, and of Stimpson in this country, and having obtained a good idea of the local marine fauna of Casco bay, in Maine, it was with no little interest and expectation that we dropped the